Australasian Plant Conservation

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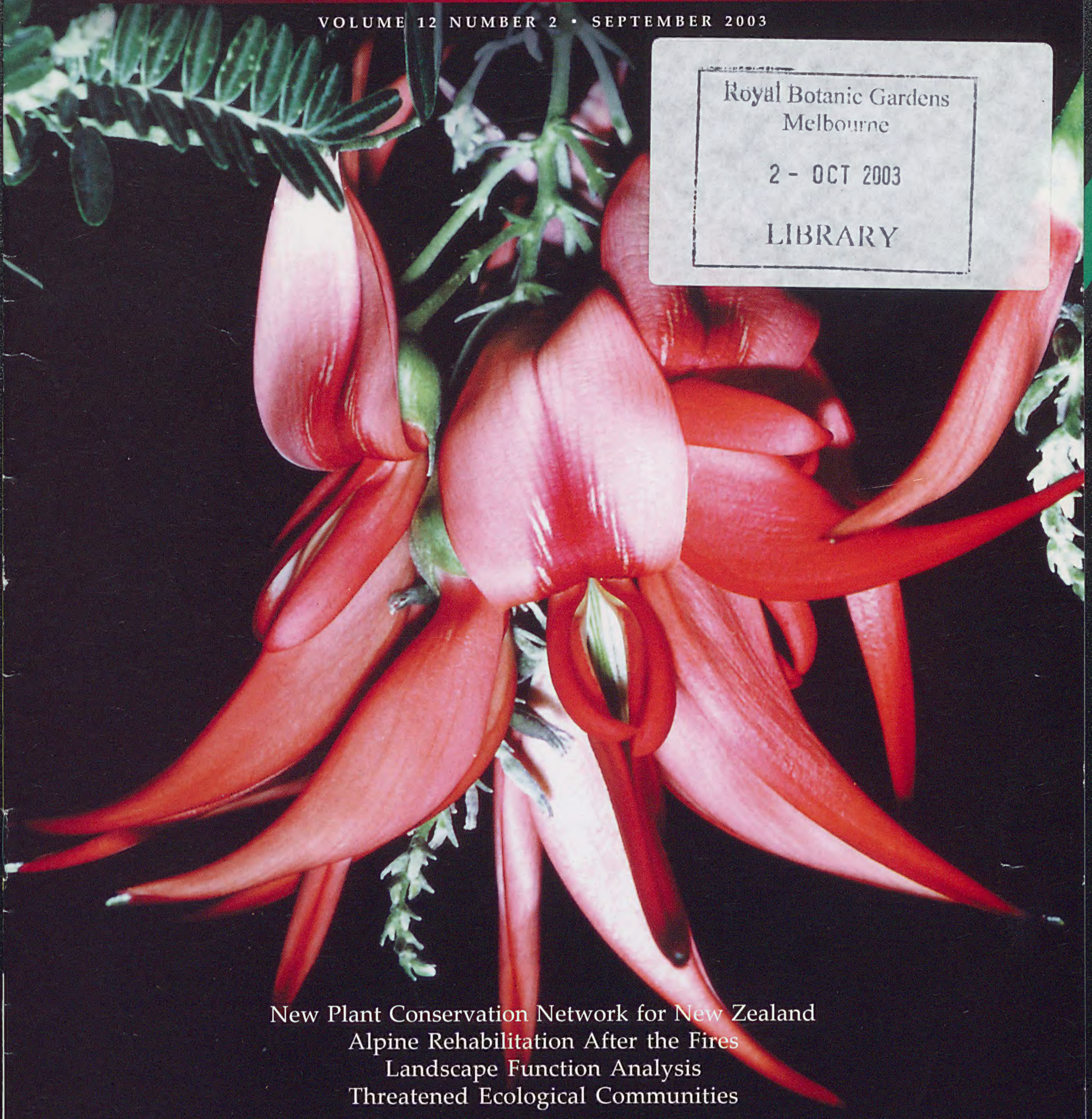

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New Plant Conservation Network for New Zealand
Alpine Rehabilitation After the Fires
Landscape Function Analysis
Threatened Ecological Communities

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Australasian Plant Conservation Editor

Fiona Hall, and thanks to Tracey Armstrong and Siobhan Duffy

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Front cover: *Clianthus puniceus*, a nationally threatened plant in New Zealand. Photo: Jeremy Rolfe.

Cover design: Siobhan Duffy, CSIRO Plant Industry.

**ANPC Inc.
Mission Statement**

"To promote and develop plant conservation in Australia"

Contributing to *Australasian Plant Conservation*

Australasian Plant Conservation is a forum for information exchange for all those involved in plant conservation: please use it to share your work with others. Articles, information snippets, details of new publications or research, and diary dates are welcome. The deadline for the December 2003 issue is the 15th of October 2003.

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Jeanette Mill: Thanks, and bon voyage!

ANPC Committee

The Australian Network for Plant Conservation's National Coordinator, Jeanette Mill, has left the ANPC to pursue a new career path, while also enjoying an extended and well-deserved overseas holiday.

Jeanette began working for the ANPC in early 1994, while undertaking the Student Botanical Internship at what was then the Australian National Botanic Gardens (ANBG) Herbarium. In the course of the internship she was rostered to help the then ANPC management team of Mark Richardson, Geoff Butler and Lyn Meredith. Talent-spotters from 'way back', they made her an offer of temporary work helping in the ANPC office. Having a degree in psychology, she knew institutional madness when she saw it, and agreed.

1994 was only the third year of the ANPC's existence. The organisation was in the middle of a growth phase, and was heavily involved in promulgating the philosophy of *integrated conservation* — that ex situ conservation should serve the interests of in situ conservation, the preservation wherever possible of natural populations in natural habitats.

The plant conservation scene was very different in those days. There were very few non-government organisations dealing with plant conservation at all, and no others specifically dedicated to it on a national scale (this at least is still true today). The Landcare movement was only just beginning to take off, and local initiatives and funding were in their infancy.

Jeanette worked as part of the team that by early 1996 had made the ANPC an established national organisation. Two important ANPC documents — the national Germplasm Guidelines and the Translocation Guidelines — were in the final stages of production, under the auspices of the Australian and New Zealand Environment and Conservation Council (ANZECC). These were the first successful attempt to set consistent national standards for these fundamental procedures in plant conservation practice, and reflected the ANPC's ability to bring the best scientific expertise to bear on practical problems in a way that could be understood and followed by the on-ground conservation practitioner.

Jeanette helped facilitate that process and was instrumental in the effective publicising of those two documents after their publication — without which they would not have attained the status they now have. Jeanette was also instrumental in consolidating the early membership of the ANPC and fostering regional groups around the country — no easy feat. Having earned the respect of members in all states, she was an obvious choice to succeed Mark Richardson as National Coordinator when he left Canberra for the browner fields of Alice Springs in January 1996.

Jeanette was Coordinator during most of the period of development of the ANPC's training courses. These courses have been a crucial feature of the organisation's development, and are one of the best and most accessible avenues for community conservation practitioners to interact directly with a wide range of conservation agency and scientific staff in a mutual learning environment — to the benefit of all. Jeanette's dedication to securing funding for these courses, and for their implementation, has been truly remarkable.

As Coordinator, she and then-President Henry Nix had the time-consuming and relatively thankless task of steering the incorporation of the organisation, a vital step in the changing funding climate of the second half of the 1990s. The transition to a more structured organisation was not always straightforward, and Jeanette's consistent work in the office and with the Committee of the time helped the process go smoothly.

Who's who in the ANPC National Office?

There are new staffing arrangements in the ANPC National Office:

- **LAURA VALLEE** returns to the organisation on a three-days-per-week basis to continue work on the grant-funded "Best Practice Guidelines" project, which includes the revision of the ANPC's Translocation Guidelines publication.
- **CLAIRE BROWN** returns on a two-days-per-week basis to work on office coordination and membership servicing.
- **FIONA HALL** continues to help with *Australasian Plant Conservation.*

Please note that email arrangements have changed: all email for ANPC should now be directed to anpc@deh.gov.au. Phone and fax numbers remain unchanged, as does the postal address (see page 1 for details).

The ANPC today is operating in a very different climate. There are many organisations competing for a shrinking conservation funding dollar, and sponsorship money is scarce. It is a tribute to Jeanette, and also to the ANBG which has consistently hosted and supported the ANPC National Office, that the ANPC survives and is still able to play its vital and pivotal role as the national plant conservation non-governmental organisation (NGO). It is also to her credit that the ANPC is seen as one of the foremost national plant conservation NGOs around the world, acting as an Australian focus for such international initiatives as the United Nation's recently adopted Global Strategy for Plant Conservation. Sadly, it is that new funding climate which has led to the ANPC having to realign its office staffing arrangements, and to terminate the full-time coordinator position. This has coincided with Jeanette, after almost ten years with the organisation, feeling a need of her own for a change.

We thank her for her hard and dedicated work for plant conservation in Australia, and we wish her all the very best for the future.

What's in a name?

Lyn Meredith

So it's farewell then *Danthonia*. Taxonomy has beaten us. And you wouldn't believe how much deep thought went into devising the name *Danthonia* for the ANPC's newsletter. Ten years ago, when we were much younger and considerably more innocent, ANPC came into being (just like that) and it was thought that it would be useful to communicate in some way with our supporters. Following the conference with the fiendishly clever name of 'Protective Custody', Mark Richardson, Geoff Butler and I sat down to think of a way to give people an update on what was happening. Geoff devised a one-sheet newsletter which he called 'Update' (who says we have no imagination?) and that sufficed to keep the crowds quiet for a few months until we had something more to report.

We had all been given these new-fangled computers at the Australian National Botanic Gardens and we found that our computers were loaded with something called 'Island Write', a desk top publishing program. This was a fairly sophisticated (for the time) program but infortunately none of us had a clue about how to use it. Training, you say: what is that? we would ask.

We were put in touch with a lady who we were told could help us and we approached her with a view to getting guidelines on setting up a newsletter. Along came Cathy one day; she and I sat down to nut out the shape of the publication. I found out how to lay out pages and design an overall format that would give a consistent appearance to the finished publication. Cathy laid out a front page with title block and space for a running scanned-image.

And then came the big question. *"What are you going to call it?"*, she asked. We'd given it a lot of thought and I was ready for this. *"Newsletter"*, I said proudly. She was quite good and didn't laugh too much. *"No, really?"*. *"That's it"*, I said, *"we don't want anything too difficult for the customers"*. *"You really should have something more catchy, something a bit different from all the other things called, er, Newsletter"*. She looked around the office for inspiration (no point in looking to me after all, 'Newsletter' was my best shot). *"How about Banksia, Grevillea, something like that; short and suggestive of the Australian flora?"* Cathy looked on a bookshelf and taking down a copy of Baines genera etc. started to leaf through it. *"Acacia, Banksia, no perhaps not. Allocasuarina, no…."* She kept turning the pages. My head was aching and my brain was full. *"Codonocarpus, not really very catchy is it? Danthonia, that's quite a nice name, are there any endangered danthonias?" "My word"*, I said helpfully, *"really?"* And I started to tell her about the plant in Tasmania found outside the take-away food shop (You must have heard the story). But Cathy wasn't interested in details. *"Then we'll call it 'Danthonia'"* she said, and lo, it was so.

When you think about it, it wasn't so bad. There were objections from pedants right from the start but we laughed them off. After all that effort we were not going to change merely for scientific quibbles. But taxonomy beat us in the end. I always knew we should have called it 'Newsletter'.

Lyn Meredith was one of the founders of the ANPC

Editor's note: Sharp-eyed readers may have spotted a few changes to the title of this publication over the last few months. The ANPC's newsletter has evolved considerably over its 11 years of existence. It is now much more than a newsletter reporting the doings of one organisation, the ANPC. Instead it now reflects and depends on the contributions of its many and diverse members; and the quality and range of its articles bear this out. Thus, as well as changing its name from *Danthonia* to *Australasian Plant Conservation*, the ANPC feels it is also more appropriate to call it a bulletin rather than a newsletter. No more changes!

New Zealand Plant Conservation Network officially launched

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New Zealand is world renowned as a biodiversity hotspot; 80 percent of New Zealand's vascular plant species are found nowhere else in the world. In a recent conservation assessment, 119 indigenous vascular plant taxa were classified as acutely threatened in New Zealand with a further 102 taxa in decline. In addition, 89 bryophyte and 50 fungi taxa are also acutely threatened (for definitions of New Zealand's new threat categories see www.nzpcn.org.nz).

Threatened plant species include the Chatham Island forget-me-not (*Myosotidium hortensia*) (see Figure 1) and the kakabeak (*Clianthus puniceus* — featured on the front cover of this bulletin*)*. Both face extinction in the wild as a result of human development, spread of weeds and damage caused by animal pests. The need for collaboration to ensure protection for these species has never been greater, and the establishment of a national plant network in New Zealand provides one mechanism to achieve this. Preventing the extinction of New Zealand's most threatened native plants and plant communities is the vision of the New Zealand Plant Conservation Network, officially launched in Wellington (New Zealand) in early August.

Over 100 people attended the inaugural meeting, including botanists, horticulturalists and representatives of restoration groups, botanic gardens, zoos, local councils, universities and the Department of Conservation. The main focus of the meeting was the protection and recovery of threatened plants and their associated communities, structured around the targets of the Global Strategy for Plant Conservation (GSPC). Those present discussed global and national plant conservation issues and developed strategies and priorities for action to prevent further decline in indigenous species.

Dr Kingsley Dixon (President of the Australian Network for Plant Conservation) gave the opening address to the network. He described the 16 targets of the GSPC, which involve the protection of important plant areas, education and training, cultivation of threatened species and species restoration. He explained how by establishing a network New Zealand had already implemented Target 16 of the Global Strategy. Kingsley then talked briefly about the work of the ANPC (for example, its training programmes) and described how the network was approaching its eleventh birthday.

Peter de Lange (Chief Plant Conservation Scientist at the Department of Conservation) then outlined the precarious nature of New Zealand's threatened plants and identified key areas for future work including biosystematics, legal protection of plants and the need to include cryptogams and fungi in conservation programmes.

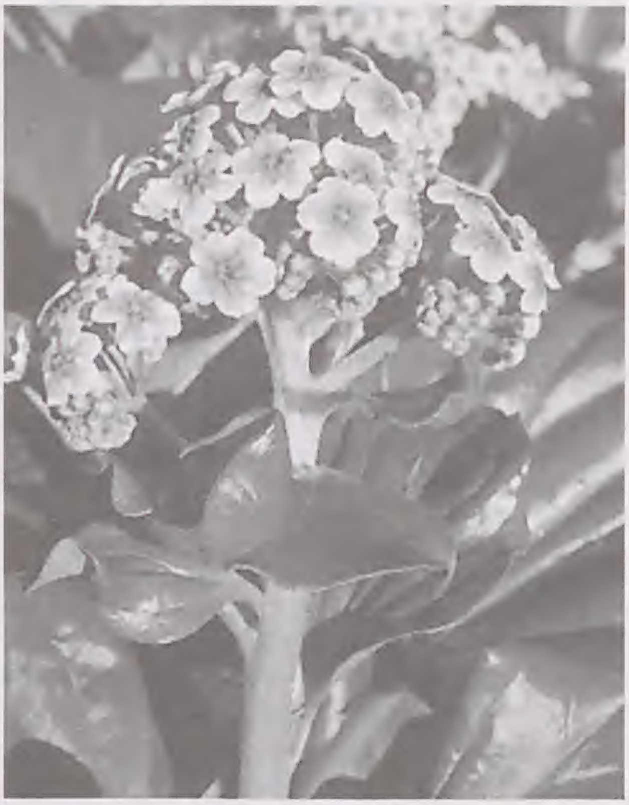

Figure 1. The threatened species Myosotidium hortensia *(Chatham Island forget-me-not). Photo: Gillian Crowcroft*

Sir Paul Reeves, former Governor-General of New Zealand, launched the Network and received gifts from the Network in the form of threatened plants to be used in local restoration projects. The new national website (www.nzpcn.org.nz) devoted to native plant conservation was then launched. The site is intended to provide information about native plant conservation in New Zealand and, in particular, information about threatened species and key people.

Workshops were held in the afternoon to determine how New Zealand is to implement the GSPC. Some key recommendations and conclusions from the workshops were that:

- The Network should **act as a coordinating body** encouraging development of lists of threatened plants and communities (both national and regional) and promoting involvement of all agencies and the public.

- The Network should help to **collect information** needed to be able to complete threatened species lists. It should also publicise gaps in knowledge of biodiversity (e.g., algae, fungi, bryophytes and data deficient species) and raise awareness of reasons to protect plant communities and species.
- An **Important Plant Area project** in New Zealand would be good advocacy for plant conservation in New Zealand and throughout Oceania, good for providing a baseline of the current state of important plant areas in New Zealand and for prioritising future protection efforts for native plant life.
- The Network should **act as the lead organisation** for the Important Plant Area project, establishing a key stakeholder group and coordinating meetings to develop a national process for the project.
- Greater protection for acutely threatened plants in New Zealand is a high priority and the Network **should pursue legal protection** for native plants through scoping out issues and options and reviewing overseas experience.
- The Network should **identify plant conservation education resources** and programmes that currently exist (i.e., undertake a stocktake) and promote examples of good practice.
- The Network should **identify gaps** in plant conservation education and aim to fill the gaps by preparing and implementing an education strategy.

Opportunities for linkages between the work of the Australian and New Zealand plant conservation networks became clearer during the day. These could be through representation on committees; through combined use of the ANPC's bulletin *Australasian Plant Conservation;* through collaboration on projects such as establishing Australasian guidelines for threatened plant monitoring; assisting with weed research on native species causing problems in each others' countries; or running plant training courses throughout Oceania. Collaboration may also provide opportunities for work throughout Australasia and Oceania to increase awareness of plant conservation issues and to improve plant conservation programmes.

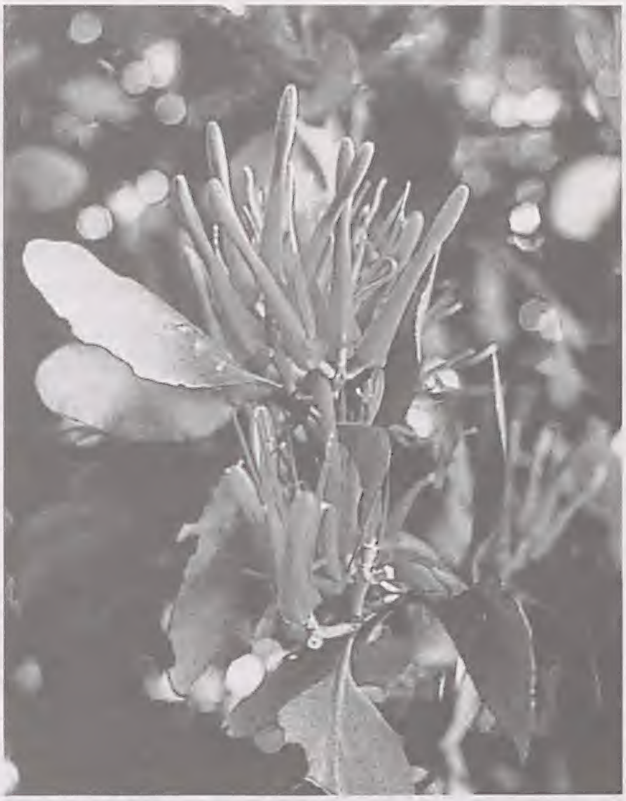

Figure 3. The threatened scarlet mistletoe, Peraxilla colensoi. *Photo: David Norton*

Since its establishment in April 2003, the New Zealand Plant Conservation Network has grown to over 150 members and will play a key coordinating role in the drive to ensure protection for New Zealand's plant life.

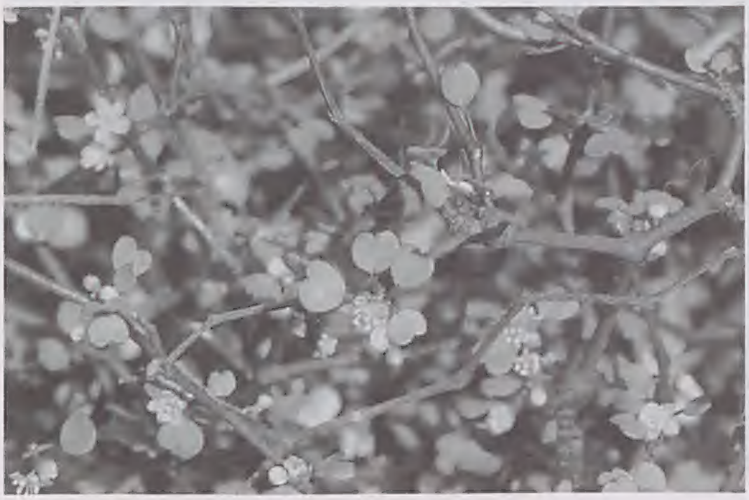

Figure 2. Shrubby tororaro, Muehlenbeckia astonii, *another threatened plant in New Zealand. Photo: Jeremy Rolfe*

Membership of the New Zealand Plant Conservation Network is open to any individual, group or government agency. You can join directly on the web site or download a copy of the membership form. Costs to join are as follows: individual: NZ$30; concession: NZ$20; corporate: NZ$200; NGO: NZ$75

For more information, or to join the network, please contact us as follows:

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Web site: www.nzpcn.org.nz

Rehabilitating threatened alpine communities in north-east Victoria after the 2003 fire

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Large parts of the alpine areas of north-east Victoria were adversely affected by the fires of early 2003. The damage was caused both directly by the fires, and more seriously by bulldozer lines pushed through the alpine areas as fire breaks. The fire-affected areas, whilst heavily burnt, were relatively stable. The roots of most plants were still intact and predominantly alive after the fire as was evident by the re-shooting of many species from lignotubers and root stocks. The bulldozer lines were, however, highly susceptible to erosion, with deep layers of dust and bare soil. Many were put through very steep terrain and some were put through threatened alpine communities such as alpine moss-beds, snowpatches and mountain pygmy possum habitat.

As winter was only a few months away, we needed to start rehabilitation work immediately after the fires. The work was supervised and implemented by Warwick Papst, Senior Scientist with the Department of Sustainability and Environment (DSE) and myself. Other people involved were the ground crews of the Falls Creek and Mt Hotham Ski Resorts.

In this article I describe how we rehabilitated three of the protected alpine communities.

Snowpatch community

The snowpatch ecological community at the top of the Big Dipper ski run at Falls Creek is listed as threatened under Victoria's *Flora and Fauna Guarantee Act, 1988*. Snowpatch communities are most often on a south facing slope and usually hold onto snow into the summer months. They are very important as they essentially release high volumes of water into the landscape over a long period. This ultimately feeds water slowly into the catchment and reduces erosion. They also promote the growth of some very beautiful herbaceous species.

Unfortunately fire-fighting efforts had pushed a very long bulldozer line through this area to act as a fire break (Figure 1). We needed to rehabilitate this community to a very high standard. It is a steep site and highly susceptible to erosion, so we decided to dig many cross drains to slow water flows and to impede sediment build up down the slope. We installed cross drains at 5 to 10 metre intervals depending on the steepness of the slope.

The damaged site was heavily planted and sown using a mixture of grasses, forbs and shrubs. The species used included: *Asterolasia trymalioides* (alpine star bush), *Xerochrysum subundulatum* (golden everlasting), *Craspedia lamicola* (Billy buttons), *Celmisia pugioniformis* (dagger leaf celmisia), *Grevillea australis* (alpine grevillea), *Leucochrysum albicans* (hoary sunray), *Olearia frostii* (alpine daisy bush), *Poa hothamensis* (ledge grass), *Prostanthera cuneata* (alpine mint bush), and *Senecio pinnatifolius* (alpine groundsel). We used 1,270 plants in all. The species of sown seed included *Poa hothamensis, Poa hiemata, Celmisia pugioniformis,* Craspedia spp. and other mixed forbs. The seed was sown about 12g per square metre. The area was also mulched using indigenous *Poa hothamensis* and *Poa costiniana* straw, which is a by-product of harvesting native grass seed.

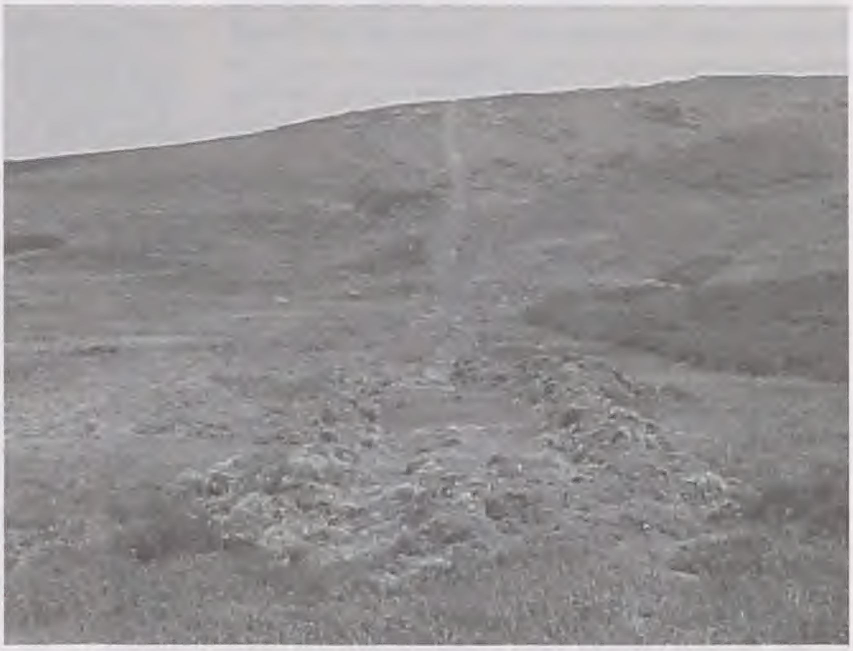

Figure 1. A long steep bulldozer line at Falls Creek. The vegetation at the top of the line is the 'Big Dipper' snowpatch. Photo: Elizabeth MacPhee

Alpine moss-beds (peat bogs)

Alpine moss-beds are another threatened community protected under the Flora and Fauna Guarantee Act. They are very important for absorbing high volumes of water when snow melts and during heavy rain. They are also very important for controlling the quality and quantity of water that is released into the catchments of these areas, as well as providing habitat for many rare invertebrates and bryophytes. Many of the alpine moss-beds were burnt or bulldozed during the fire in the Victorian alpine region. Their rehabilitation is a slow and difficult task, with many of the bogs requiring extensive restoration. This will take much more than one season of rehabilitation work to achieve and will be the principal focus of the Ovens Rehabilitation Unit over the next few years, particularly in the Alpine National Park. However, some bog rehabilitation work began in autumn 2003, mostly in the Falls Creek Ski Resort, where bulldozer lines had been installed as fire breaks.

The peat bog at the bottom of Headwater area at Falls Creek is at the base of a ski run and was very degraded after the fire. We used an excavator to push back many of the large sods and as much vegetation as possible. Once this was done it was vital to install weirs to slow water flow and collect silt (Figure 2). These were constructed using hessian sacks wrapped in special synthetic material used in silt traps. They were then pinned and rocks used to ensure the flow of water went over the weirs and not under them or around them. Once these had been constructed a small number of indigenous wetland plants were planted to speed up the rehabilitation process. The species used were: *Carex gaudichaudiana* (tufted sedge), *Epacris paludosa* (swamp heath), *Gonocarpus montanus* (mat raspwort), *Myriophyllum pedunculatum* (mat water-milfoil), *Isolepis crassiuscula (*alpine club-rush*)* and *Empodisma minus* (rope rush).

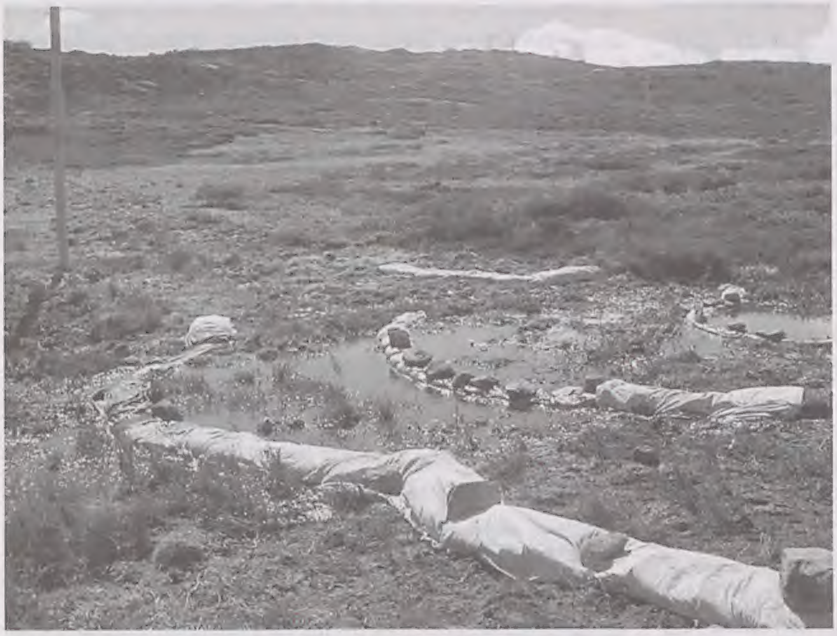

Figure 2. Weirs being built at the Headwater peat bog. Photo: Stan Cantwell

The moss-bed in the Gully area at Falls Creek was also in a ski run area and had been bulldozed. This bog is within a closed heath community dominated by shrubs such as *Epacris paludosa* (Swamp Heath) and *Baeckea gunniana* (alpine baeckea) which indicate a high volume of water present. It also supports other species, such as *Empodisma minus* (rope rush) and sphagnum moss, which are indicator wetland species. As we only had a limited number of wetland species available, this bog system had weirs built and about 100 *Carex gaudichaudiana* (tufted sedge) planted in it. The original *Empodisma minus* and sphagnum moss clumps were replanted to aid the rehabilitation of this bog system. Approximately 200 shrubs were also planted below the wetland as this area was steep and very susceptible to erosion. Species used were: *Olearia phlogopappa* var. *flavescens* (dusty daisy bush), *Ozothamnus secundiflorus* (alpine everlasting) and *Prostanthera cuneata* (alpine mint bush*)*.

Mountain pygmy possum habitat

Mount Higgenbotham is the highest peak within the Mount Hotham Ski Resort and is home to the rare and threatened mountain pygmy possum. The peak had been extensively bulldozed and used as a turnaround area for many fire suppression vehicles. The boulder screes and vegetation had been pushed aside, leaving a large area of soil exposed. It was important that this area was rehabilitated early in the autumn as the ground in this area usually freezes very early in the winter. Frozen or even very cold soils inhibit newly planted tubestock establishing and the work would not have been successful had it been done closer to winter. The pygmy possum habitat throughout the ski resorts and Alpine National Park had been severely reduced and population numbers were well down on what they had been before the fire. We rapidly reinstated the boulders and planted *Podocarpus lawrencei* (mountain plum pine) to provide some sort of natural habitat for any surviving possums. A mixture of other shrubs was also used for this site: *Grevillea australis* (alpine grevillea), *Prostanthera cuneata* (alpine mint bush*)*, *Olearia phlogopappa* var. *flavescens* (dusty daisy bush) and *Ozothamnus secundiflorus* (alpine everlasting). A small number of *Senecio pinnatifolius* (alpine groundsel) and *Plantago europhylla* (broad plantain) were also planted. In all, 460 plants were used. The seed used was a mixture of *Poa fawcettiae* and *Poa hothamensis* at 10g per square metre. The area was mulched using native grass straw and weed-free fescue straw bales.

Ensuring local provenance

All the species used for the rehabilitation work in the Victorian alpine areas were of local provenance. That is, the plant material used was propagated from seed, cuttings or division derived from plants growing in the area and planted back into the same areas. The species selected for planting at each site were known to occur in these communities and were also known to be effective for rehabilitating disturbed alpine landscapes.

All plants and seed used were provided by the Alpine Rehabilitation Unit, which is based at the Department of Sustainability and Environment, Ovens office. For more than 10 years the Alpine Rehabilitation Unit has been collecting and propagating a wide range of indigenous plant species from the Bogong High Plains, Mt Bogong, Mt Nelse, Mt Feathertop, Mt Higgenbotham and most of the surrounding landscape. The main focus of the alpine project has been to research the propagation requirements of a large range of alpine species and to rehabilitate degraded alpine landscapes. The rehabilitation work has included the repair of high altitude walking tracks, ski slopes and lodge sites in ski resorts, areas denuded as a result of the Snowy hydroelectric scheme and degraded alpine bogs. All the rehabilitation work has had a research component to it, where different rehabilitation materials and plants are assessed for their success in the landscape.

Many alpine species are either very difficult to produce or do not readily establish once planted in the landscape. Alpine regions are very difficult to rehabilitate and without tested and reliable rehabilitation practices, much effort and money can be wasted. The length of time the Unit has been doing this work has allowed us to develop effective techniques for sustainable rehabilitation using indigenous species. Though of catastrophic proportions in the Victorian Alps, the impact of the 2003 fire would have been much worse had there not been a specialised rehabilitation team with large amounts of native grass seed and indigenous tubestock ready and waiting to repair these fragile, but beautiful, alpine communities.

We will be closely monitoring the post fire rehabilitation work, as well as the ability of the alpine region to regenerate after being heavily burnt. It is indeed a rare opportunity to measure and observe how the Australian Alps respond to fire and how to further improve rehabilitation techniques.

Big picture, local assessment

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Perhaps one of our greatest challenges is to communicate and apply our understanding and knowledge of effective vegetation management practices at a landscape scale. Furthermore, the application of these practices must be demonstrated across several major natural resource management issues including dryland salinity, sustainable land management, riverine and floodplain management, nature conservation (plants, animals and ecosystems), and the management of exotic flora and fauna.

In meeting this challenge, there will be many opportunities to apply innovative cutting-edge vegetation management techniques. In February 2003 we attended an ANPC workshop on *Landscape Rehabilitation: Approaches and techniques* in Yass, NSW. One of the presenters was David Tongway from CSIRO Sustainable Ecosystems, who talked about the innovative technique Landscape Function Analysis (LFA). LFA *"is a monitoring procedure, using simple indicators, to assess how well an ecosystem works as a biogeochemical system"* (Tongway 2003a). Since 1994 it has been applied in over 30 locations in every state and territory in Australia and across most forest types. In this article we consider the practical applications of this approach for vegetation rehabilitation.

LFA examines how biological and physical components of an ecosystem are functionally related. It treats landscapes as systems, recognising the inherent organisation within landscapes and the assessment of 'habitat quality' using soil/terrain type criteria. Just as you need to consider factors involved in site stabilisation prior to revegetation, so LFA first considers the functional relationships between climate, soil/terrain type and vegetation before applying the principles of vegetation dynamics or biodiversity to develop a rehabilitation model. This includes the concept of soil as habitat and the understanding of the appropriate soil/terrain habitat for specific plants and animals, in the assessment of its 'habitat quality'. LFA defines a functional ecosystem as *"one where the net loss of resources is very low and processes involving resource conservation and cycling are active, whereas a dysfunctional ecosystem tends to lose resources and have less active resource conservation processes"* (Tongway 2003a).

The rehabilitation objective is to move from the degraded niche to the required environmental niche for desired biota. That is, rehabilitation will take place if the processes that regulate resource use are returned, or their return is facilitated in some way. The key question is: what are the missing or ineffective processes in the landscape that need to be restored or replaced, in order to improve the soil habitat favourably for the desired biota?

Landscape Function Analysis involves a field methodology to provide data in the form of the indicators of system processes. These include:

- Landscape organisation, reflecting the overall resource 'economy': how does this landscape use and regulate vital resources in space and time?
- Soil surface condition, comprising: (a) stability: resistance to erosion; (b) infiltration: capacity to infiltrate rain and run-on water; (c) nutrient cycling: organic matter decomposition and cycling.

All these indicators are measured in situ using transects at the hill-slope scale, orientated in the direction of resource flow. In soil assessment, several interrelated indicators are measured to describe aspects of landscape function (Figure 1). Landscape Function Analysis has been broadened to the development of Ecosystem Function Analysis (EFA) by including vegetation dynamics and habitat complexity measurements along the transects used for LFA (Figure 2):

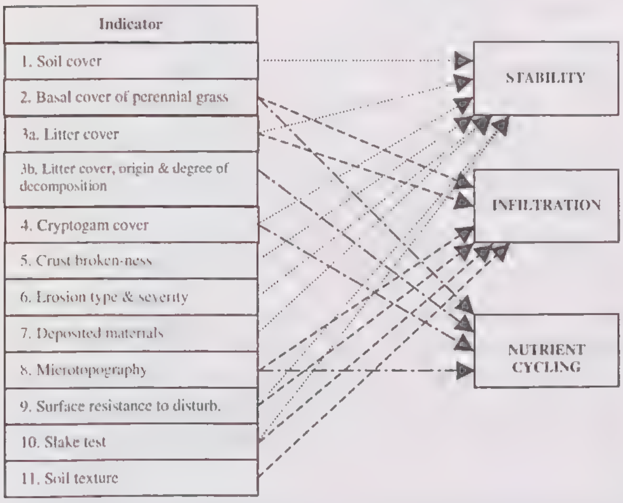

Figure 1. The combination of soil surface condition classes to derive indices of stability, infiltration and nutrient cycling (Tongway, 2003b)

- Vegetation dynamics: density, species composition and size of specified vegetation.
- Habitat complexity: the level of ecosystem development for mammalian habitat niches.

This data is then analysed using a purpose-built statistical program developed by CSIRO, interpreted collectively with end users, and rehabilitation strategies are designed from this assessment (CSIRO offer specific training programs in LFA and the analyses involved).

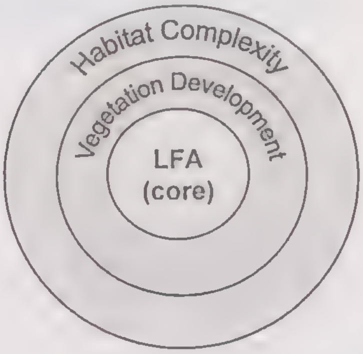

Figure 2. The relationship between different components in the EFA framework (Tongway, 2003b)

In implementing LFA/EFA, there are several implications for conservation practitioners:

- Soils and soil health play a major role in LFA; practitioners will require appropriate training in soils to incorporate a fuller understanding of their role and function in vegetation management.
- To monitor the success of site rehabilitation, before rehabilitation work begins we need to conduct an effective baseline assessment of landscape function, using LFA as one of the key components.
- This assessment must be linked to the 'state and transition model' where, if a certain point is passed, a degraded landscape will continue to degrade.

The CSIRO web site contains a page on EFA (www.cse.csiro.au/Research/Program3/efa/index.htm) that includes links to detailed training manuals and background information on the approach, all of which can be downloaded.

While LFA may prove to be an effective rehabilitation tool in Queensland, it is sobering to note that long-term natural resource management in this state continues to be eroded by land clearing, resultant soil losses and a substantial increase in the sedimentation and nutrification of water systems. While this is partly a legacy of land use practices, on the ground the situation has been dramatically exacerbated by current drought conditions. Any rehabilitation effort at a landscape scale cannot hope to succeed without these issues being addressed.

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Threatened ecological communities

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It is commonly known that plant or animal species at risk of extinction in the wild may be declared threatened under the Commonwealth's *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). They may also be listed under separate laws in the states and territories using similar listing criteria. It is less well known that ecological communities (defined below) can also be listed under these laws, and for the same reason — because they are at risk of disappearing from the landscape. In this article I explain what threatened ecological communities are, and discuss some of the issues associated with listing and protecting them.

So what is an ecological community, how many have been listed by the Commonwealth, and why have they been listed? Under the EPBC Act, an ecological community is defined as *"an assemblage of native species that inhabits a particular area in nature"*.

It is the Commonwealth Minister for the Environment who decides whether an ecological community should be declared as threatened or not. In reaching a decision, the Minister must only consider matters that relate to the survival of the ecological community concerned, and receives advice from the Threatened Species Scientific Committee. The types of factors taken into account in determining whether a community should be declared as critically endangered, endangered or vulnerable include:

- the extent of decline in the community's geographic distribution
- the total area of the community's geographic distribution and whether there is a demonstrable threat to it
- the extent of loss or decline of species that are functionally important in the community
- the extent to which the integrity of the community may have been reduced
- the rate of continuing detrimental change in the community
- the probability of the community becoming extinct, based on quantitative analysis

An ecological community may be listed as **critically endangered** if it is facing an extremely high risk of extinction in the wild in the immediate future (i.e. over the next 10 years) or **endangered** if facing a very high risk of extinction in the near future (i.e. over the next c. 20 years). If an ecological community is facing a high risk of extinction in the wild in the medium-term future (i.e. over the next c. 50 years) it can be declared as **vulnerable** under the EPBC Act. To date 29 communities have been listed under the Act, one of them—*Swamps of the Fleurieu Peninsula*—as critically endangered and the remainder as endangered (Table 1).

Twenty-two of the listed communities have a restricted distribution within a single state. For many, this is because they have specialised habitat requirements (see Table 1), but they may also have been substantially cleared. For example, the listed *Shrublands on southern Swan Coastal Plain ironstones* may have covered c. 1200 hectares (the extent of the ironstone soil type); today only 13 remnants remain, together covering just over 89 ha. Each of the six listed woodland and shrubland communities in the south-west of Western Australia occur as remnants whose total area is between 43 and 106 ha per community. In contrast, communities such as the *Montane heath and thicket* in the eastern Stirling Range, WA, and the *Silurian Limestone Pomaderris shrubland*, Vic., have never been cleared, but still only cover 520 ha and 39 ha (respectively).

Seven listed ecological communities are distributed in more than one state. One of these occurs in many small, discrete areas scattered around the edge of the Great Artesian Basin where the groundwater discharges to form mound springs. The remaining six communities once covered tens or

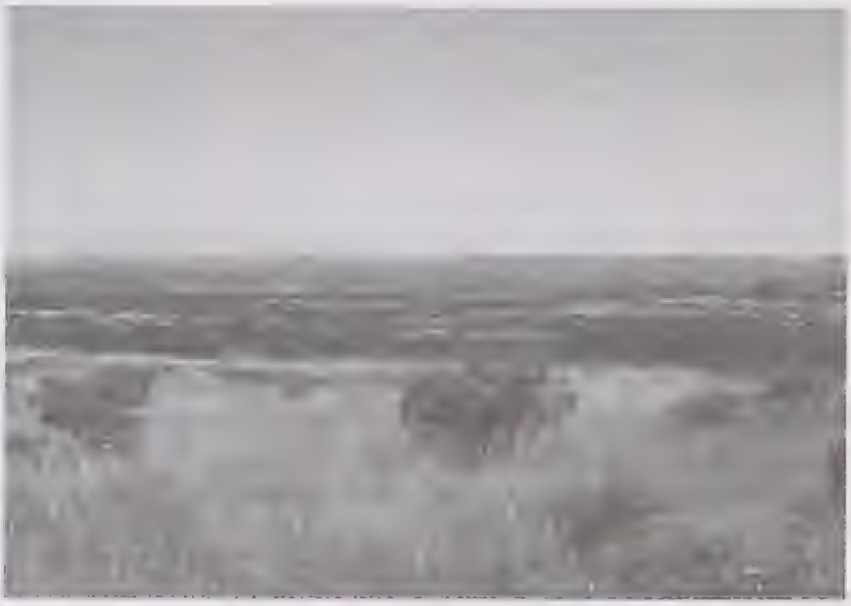

Figure 1. Cleared Brigalow in Queensland. Clearing has been a major cause of extensive ecological communities being declared threatened. Photo: Murray Fagg

Table 1. Threatened ecological communities listed under the EPBC Act

Ecological community	Where is it?	Why was it listed?
	Restricted distribution	
Aquatic Root Mat Communities (five communities listed)	WA, Leeuwin Naturaliste Ridge & Swan Coastal Plain	Restricted, sensitive habitat (caves)
Banksia Scrub	NSW, eastern suburbs of Sydney	Remnants in cleared landscape
Biota associated with mound springs	Edge of Great Artesian Basin in NT, SA, Qld, NSW	Restricted/sensitive habitat (natural groundwater discharge)
Casuarina obesa wetlands	WA, Toolibin Lake	Restricted habitat (perched wetland)
Complex Notophyll Vine Forest	Qld, Atherton Tableland	Specific habitat (basalt soils) and extensively cleared
Eucalypt woodlands	NSW, Cumberland Plain	Remnants in cleared landscape
Montane heath and thicket	WA, Eastern Stirling Range	Restricted habitat (high altitude)
Plants and invertebrate animals of tumulus springs	WA, Swan Coastal Plain	Restricted, sensitive habitat (organic mound springs)
Pomaderris shrubland	Vic., south-east end of the Australian Alps	Restricted habitat (Silurian limestone)
Sedgelands	WA, Swan Coastal Plain	Remnants in cleared landscape; specialised/restricted habitats (Holocene dune swales)
Swamp community	SA, Fleurieu Peninsula	Restricted habitat (swamp) in largely cleared landscape
Thrombolite (microbial) community	WA, Swan Coastal Plain	Specialised/restricted habitats (coastal freshwater lake)
Transition forest	NSW, Sydney region	Restricted habitat (shale/sandstone)
Woodlands and shrublands (6 communities listed)	WA, Swan Coastal Plain	Remnants in cleared landscape; specialised/restricted habitats (limestone/ironstone)
	Extensive distribution	
Bluegrass (Dichanthium spp.) dominant grasslands	Qld, from near Townsville, south to near the NSW border	Extensively cleared
Brigalow (*Acacia harpophylla*) woodlands	Qld, from near Townsville, south to northern NSW	Extensively cleared
Buloke (*Allocasuarina luehmannii)* woodland	Southern riverina of NSW, north-western Vic & south-east of SA	Extensively cleared
Grassy White Box (*Eucalyptus albens*) woodlands	From southern Qld to north-eastern Vic	Extensively cleared
Natural temperate grassland	Southern Tablelands of NSW and ACT	Extensively cleared
Semi-evergreen vine thicket	Qld, from near Townsville, south to northern NSW	Extensively cleared

hundreds of thousands to several million hectares of land but have been extensively cleared (see Table 2), mainly for agricultural purposes (see Figure 1).

Many of the remnants have been degraded by activities in the past, such as the introduction of pasture species, use of fertilisers, cattle or sheep grazing, and altered patterns of burning. The least disturbed remnants are now often confined to places such as road or railway easements, travelling stock reserves, town commons or cemeteries.

The main purpose of listing an ecological community is to help ensure it does not become extinct and to promote its recovery. Under the EPBC Act, any action that might have

Table 2. Extensive ecological communities

Ecological community	Estimated original extent	Estimated extent today
Bluegrass (Dichanthium spp.) dominant grasslands	1.14 million ha	16% of original; only 10% of original in good condition
Brigalow (*Acacia harpophylla*) woodlands	7.27 million ha	c. 10% of original
Buloke (*Allocasuarina luehmannii)* woodland	SA: c. 39,000 ha; NSW: c. 10-11,800 ha; Vic.: not available	<3% (SA) to c. 10-14% (NSW) of original
Grassy white box *(Eucalyptus albens)* woodlands	Several million ha	<0.01% of original in NSW in good condition; 5-7% overall in southern NSW
Natural temperate grassland	From 386,000 ha to more than 480,000 ha.	<3% in good condition, + 5% with lower integrity
Semi-evergreen vine thicket	0.88 million ha	c. 17% of original

a significant impact on a threatened ecological community requires the approval of the Commonwealth Minister. The Act also requires the preparation of a recovery plan, which must set out the research and management actions necessary to stop the decline, and support the recovery, of the community.

If an ecological community is to be protected in this way, it is essential to know what it is and where it occurs. This requires a clear definition of the listed community. While it is usually easy to define a restricted community, it is often more difficult to define an extensive one. Most of the six extensive communities that have been listed under the EPBC Act are comprised of a number of different vegetation types in a range of landscapes. For example, the listed *Brigalow woodlands* include 16 different regional ecosystems (a combination of vegetation type associated with particular geomorphology, landforms and soils), some of which are dominated by species other than Brigalow. Also, not all of a particular vegetation type is necessarily part of the listed community, for example five Brigalow regional ecosystems are excluded from the listed community because they have not been so extensively cleared.

Vegetation condition is also an important consideration in defining listed communities. Very highly disturbed remnants are generally not considered to be part of the communities listed under the EPBC Act. This is particularly true of grasslands and grassy woodlands, where introduced plant species may form a high proportion of the total species count and/or comprise more than 50% of the perennial grass cover. Although highly disturbed areas may not be part of the listed ecological community they can still be very important, especially where very little of the vegetation remains in good condition. For example in *grassy White Box woodland*, highly disturbed remnants may still provide habitat for threatened fauna, form buffers around less disturbed areas or provide corridors between remnants that are part of the listed community.

Under the EPBC Act, some listed communities are defined in part by their association with a particular region, for example the listed Buloke ecological community refers just to Buloke within the Riverina and Murray Darling Depression bioregions. While this helps provide clarity about what is listed, it does not necessarily mean that Buloke outside these regions is not threatened. Sometimes when a listing decision is made, not enough is known about other similar communities to determine whether they are threatened or not.

Because of the complexity of their component vegetation types and the effects of past forms of land use on their condition, it is sometimes difficult to 'pin down' a threatened ecological community. If there is doubt it's important to seek expert advice, either from staff in the Australian Government Department of the Environment and Heritage that administers the EPBC Act, or from their counterparts in state government departments.

Further information

Information about ecological communities listed under the EPBC Act can be found on the web site of the Australian Government Department of the Environment and Heritage at the following address: www.deh.gov.au/biodiversity/threatened/communities/index.html

For further information on ecological communities call the Australian Government Department of the Environment and Heritage's Wildlife Information Section on:
(02) 6274 2388

Research Roundup

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Publications and Information Resources

Earth Alive! From Microbes to a Living Planet

Mary E. White
July 2003
Rosenberg Publishing

This book is a logical addition to Mary E. White's previous publications. *Earth Alive! From Microbes to a Living Planet* reveals the significance of life's bacterial ancestry, and the continuing enormous importance of the invisible world of micro-organisms that still sustain the living Earth. The book gives some idea of soil microbiology; of the symbiotic relationships between microbes, fungi and roots of plants; importance of invertebrates in webs of life; what loss of biodiversity and removal of some links in webs of life do to the environment and so on.

Available from most book stores, $49.95 hardback.

ISBN 1 877058 05

Threatened Species of the New England Tablelands and North West Slopes of NSW

NPWS Northern Directorate Threatened Species Unit
June 2003

Provides information on 145 threatened species, populations and ecological communities found in the area from Tenterfield in the north to Nundle in the south and west to Warialda, Manilla and Quirindi. Species covered in the book range from woodland birds to rare fish and from sphagnum moss communities to rare gum trees.

The book is part of a series of threatened species books produced by NPWS Northern Directorate's Threatened Species Unit.

Price $14.95 from the NPWS Conservation Programs and Planning Division office at Coffs Harbour, ph: (02) 6651 5946; Northern NSW Regional NPWS offices; and via the publications section of the NPWS web site www.nationalparks.nsw.gov.au.

Water Plants in Australia: A field guide

Sainty, SR and Jacobs, SWL. Fourth Edition, 2003
Sainty and Associates, Potts Point, NSW.

This pocket book was first published in 1987. This expanded edition covers common wetland plants, including introduced weeds, potential weeds, common native species and a few species that require protection. Chapters on blue-green algae, classification of wetlands, constructed wetlands, willows and charophytes are included.

Available from Sainty and Associates Pty Ltd., PO Box 1219, Potts Point NSW 1335 Australia.

$59.95 (hardcover). ISBN 0 9581055-1-0

Weeds and Pests: Eradicating the invasive threat

Andreas Glanznig
Position paper, WWF Australia, Sydney 2003.

This paper outlines the growing problem of invasive weeds, the gaps and weaknesses in the current national regime, and proposes a four point plan that will ensure a strong national approach to break the wave of weeds and pest animals entering Australia.

Download it from: www.wwf.org.au/downloads/position_paper_weeds_pests_0103.pdf

Electronic Addresses

NSW Biodiversity Research Network Web Site

Established to facilitate communication and cooperation among stakeholders in research on biodiversity in NSW. These stakeholders include government, private and community organisations, and individuals — both those who do the research, and those who use the research.

http://www.nationalparks.nsw.gov.au/npws.nsf/content/Research+Resources

Commonwealth Government Grants

GrantsLINK makes it easier to find out about the grants available from the Commonwealth Government, find the most appropriate grants program and apply for grants. It also helps with completing application forms.

http://www.grantslink.gov.au/

Conferences & Workshops, Courses & Fieldwork

A joint conference of the Australian Systematic Botany Society and Australasian Mycological Society with the 7th Bryological Workshop and Orchid Conservation Forum II

29 September to 3 October 2003, Melbourne

A conference celebrating 150 years of the National Herbarium of Victoria and systematic botany in Australia. Opening keynote address by Professor PF. Stevens from Missouri University and Missouri Botanical Gardens: *"Higher-level names: What is it about them that make us fight so much?"*. Associated events include a post-conference mycology foray to Rawson Village, Mt Baw Baw and a botanical art exhibition.

More information: Bronwen Hewitt, Old Physics Building, The University of Melbourne, Victoria, Australia, 3010. Phone: (03) 8344 6389; Fax: (03) 8344 6122 Email: bhewitt@unimelb.edu.au http://www.conferences.unimelb.edu.au/150years/

Weedbuster Week aims to raise awareness and increase public understanding about the problems weeds cause. There will be lots of practical activities and open days going on all round the country. See the web site for more details:

http://www.weedbusterweek.info.au/activities.htm

Botanic Gardens: Engaging Their Communities

24 -28 October 2003, Geelong

Inaugural congress of Botanic Gardens of Australia and New Zealand (BGANZ), hosted by the City of Greater Geelong and Council of Heads of Australian Botanic Gardens. Aims to examine the contemporary issues facing botanic gardens and arboreta in Australasia today in order to maintain their relevance to their communities and importance in the 21st century. There will be four themes during the congress: heritage planning and protection, conservation and science, community networking, horticulture and arboriculture, plus field trips.

For more information: http://www.anbg.gov.au/chabg/ or email: bganz2003@geelongcity.vic.gov.au

3rd Stipa National Native Grasses Conference: Sustainability and beyond

26-28 November, Cooma, NSW

Cooma Multi-function Centre at the showground. Speakers, posters and displays by producers, conservationists and horticulturalists from around the country, along with a display of some ingenious native grass seed handling equipment. The conference will begin with a bus tour to some private properties and public reserves with interesting native grasslands.

Inquiries: Christine McRae, Conference Coordinator, 1480 Bocoble Rd, Mudgee, NSW 2850 or cmcrae@hwy.com.au
or Margaret Ning on (02) 6241 4065
Email: margaretning@primus.com.au

3rd International Wildlife Management Congress 1-5 December 2003 Christchurch New Zealand

Incorporating the 16th Australasian Wildlife Management Society Conference. Co-hosted by the Wildlife Society, a wildlife science and educational association based in the USA. The theme this year is "*Ki te raki ki te tonga: ki uta ki tai* From the north to the south: from mountains to sea" and will highlight wildlife management issues common to the Northern and Southern Hemispheres.

http://wildlife2003.landcareresearch.co.nz/

3rd ESA Postgraduate Course on Current Ecology and Evolution

7 December 2003 at University of New England, Armidale, NSW

To be held the day before the annual ESA conference (see below). The aim is to acquaint future researchers with the most current thinking in ecology and evolution, calling on expertise from across Australia. Suitable for postgraduate research students or people considering undertaking a research degree. Please register for the course through the registration process for the main conference ESA2003. The cost is $75.

http://www.bio.mq.edu.au/ecology/esa2003/

ESA Ecology 2003

8-10 December 2003, Armidale, NSW

Symposia highlight particular themes in ecology by bringing together some of the most exciting recent developments in particular fields.

Register by 28 November 2003
Conference Secretariat, University of New England, Armidale NSW 2351
Ph: (02) 6773 2154
Fax: (02) 6773 3766
email: confco@metz.une.edu.au
http://www.ecolsoc.org.au/2003/index.html

Regional Groups

NSW South West Slopes

Paul Scannell, Albury Botanic Gardens
Email pscannell@alburycity.nsw.gov.au

We have had significant rainfalls since my last report and I am pleased to say that the Albury population of crimson spider orchids has jumped out of the ground in a big way. All 14 plants, plus two new seedling leaves are up, and we have eight plants ready to flower this year.

We are working closely with the newly established Victorian multi-species orchid recovery team and we may trial some new horticultural methods to assist recruitment in both the in situ and ex situ populations. We have held on-site meetings with the group caring for the Crimson Spider Orchids at the Chiltern Box–Ironbark National Park, during which we met Andrew Pritchard, the new Coordinator of the Victorian multi-species orchid recovery team, and discussed latest tactics.

We are compiling further data records into tables, to compare notes with other caretakers of similar Caladenia (Arachnorchis) populations, as we are finding some irregularities with emergence. For example, some plants come up every year and their size is dependent on rainfall and July temperatures. Others do not emerge when rainfall and temperatures are low; this may occur up to three years running, but they may still emerge in the 4th year if temperature and rainfall are good. After four years of non-emergence there is not much hope for their survival. Seedlings can take at least three good years to flower, but farmed individuals can flower in the second year.

Finally, we must wish Stephen Clarke all the very best on his retirement from the NPWS after six years and thank him for his excellent work on the Caladenia recovery team. Steve was the Senior Threatened Species Officer at the Threatened Species Unit, Southern Directorate of NPWS at Queanbeyan, NSW. He was involved in numerous recovery planning teams, including recovery planning for the Crimson Spider Orchid, Tarengo Leek Orchid, Leafless Tongue Orchid, Nowra Heath Myrtle, *Melaleuca biconvexa*, five species of threatened flora on rocky outcrops of SE NSW, four endangered ecological communities, critical habitat declaration for Bomaderry Zieria, and Northern and Southern Corroboree Frogs.

Steve is a great diplomat, mentor and gentleman. We hope retirement can provide more leisure time to stroll through the Australian bush and pursue those clarinet lessons.

Thanks, Steve, for a job well done!

For any inquiries, please contact us at the AlburyCity Parks & Recreation Business Unit on Ph: (02) 60 238 769; Fax: (02) 60 238 166

Caladenia caerulea *"Blue Caladenia" from Nail Can Hill, Albury. Photo: Peter Branwhite*

Other ANPC Regional Groups

The ANPC has several Regional Groups which play a key role in bringing together those with an interest or involvement in plant conservation to share information through activities organised in their regions. The groups enable efficient communication of best practice information on plant and ecological community conservation to be spread to agencies and groups active in on-ground works. The Regional Groups are coordinated by voluntary coordinators, and activities include seminars and workshops, field days and practical activities such as threatened plant surveys and weeding. Find out where your nearest local group is and join in their activities. If you do not have a regional group nearby, then perhaps you might like to set one up! If so, contact us at National Office and we will be happy to support you.

Melbourne Region (New!): An ANPC member, Bill Richdale, is proposing setting up a new Regional Group in the Melbourne area. The first meeting (all interested parties are encouraged to attend) will be held on the evening of 15 October. If you'd like to join, or want to know more about the group or the first meeting, please contact the ANPC National Office (see page one for contact details).

Sydney Region: Tracey Armstrong, Mount Annan Botanic Garden. Ph: 02 4634 7939
Email: Tracey_Armstrong@rbgsyd.nsw.gov.au

Illawarra and South Coast NSW Region: Paul Formosa, Wollongong City Council. Ph: 02 4225 2638
Email: pformosa@wollongong.nsw.gov.au
Roger Hart, Booderee Botanic Garden, Jervis Bay. Ph: 02 4442 1122 Email: roger.hart@ea.gov.au

Tasmania: Andrew Smith, Parks and Wildlife Service Tasmania. Ph: 03 6233 2836
Email: andrew.smith@dpiwe.tas.gov.au

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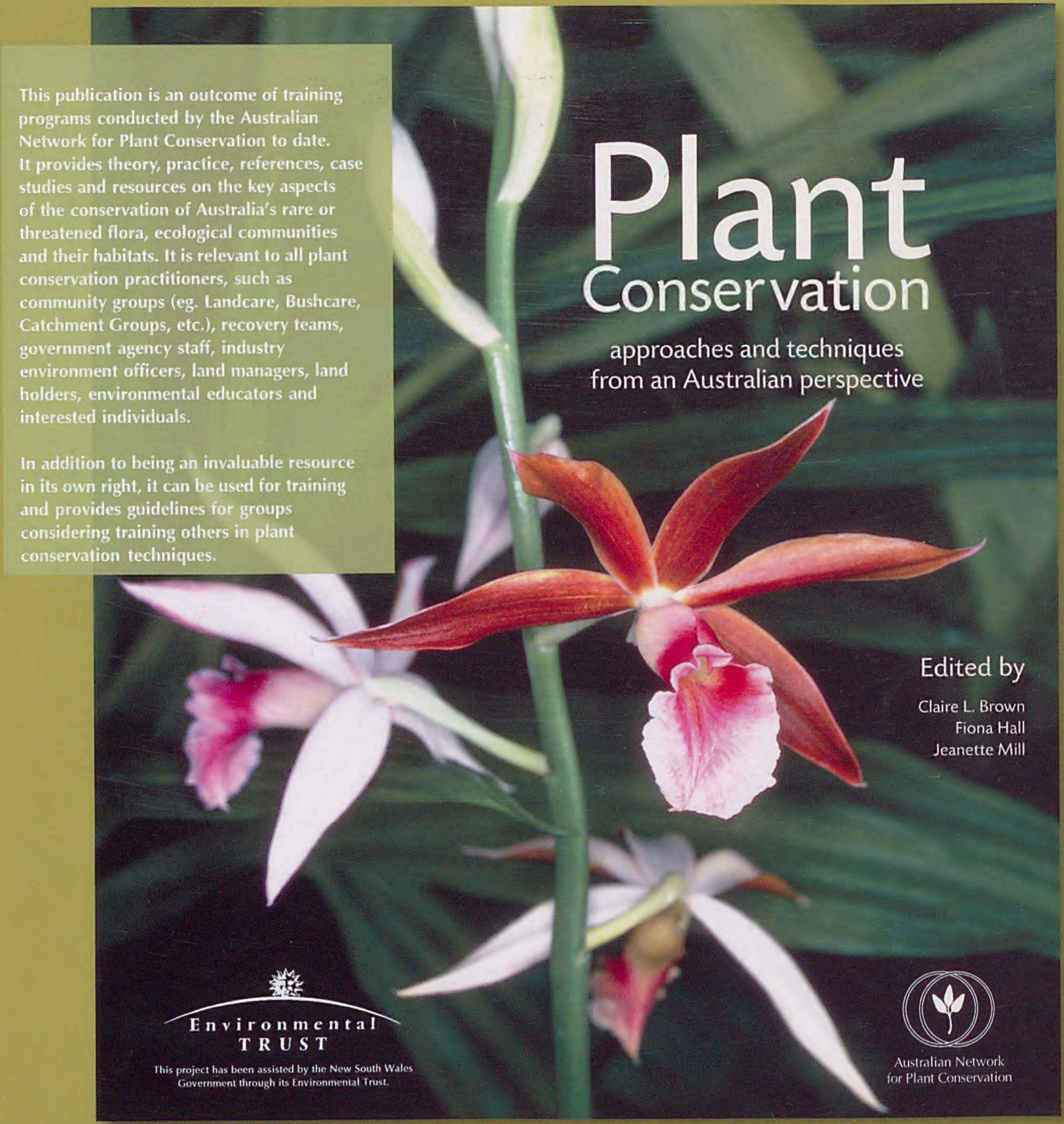

This publication is an outcome of training programs conducted by the Australian Network for Plant Conservation to date. It provides theory, practice, references, case studies and resources on the key aspects of the conservation of Australia's rare or threatened flora, ecological communities and their habitats. It is relevant to all plant conservation practitioners, such as community groups (eg. Landcare, Bushcare, Catchment Groups, etc.), recovery teams, government agency staff, industry environment officers, land managers, land holders, environmental educators and interested individuals.

In addition to being an invaluable resource in its own right, it can be used for training and provides guidelines for groups considering training others in plant conservation techniques.

Plant Conservation

approaches and techniques from an Australian perspective

Edited by

Claire L. Brown
Fiona Hall
Jeanette Mill

Environmental TRUST

This project has been assisted by the New South Wales Government through its Environmental Trust.

Australian Network for Plant Conservation

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Australasian Plant Conservation

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